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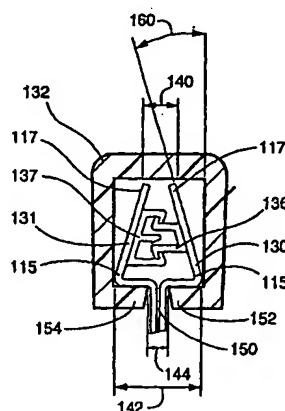
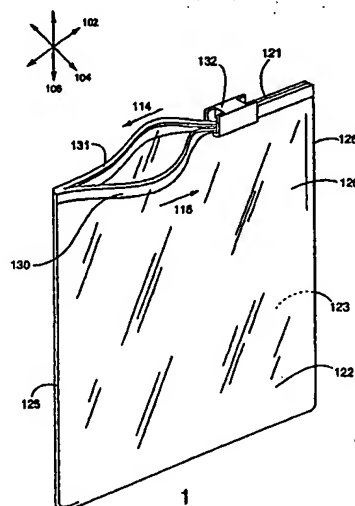
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(54) Title: **CLOSURE DEVICE**



(57) Abstract: The closure device (121) includes interlocking fastening strips (130, 131) and a slider (132). The fastening strips (130, 131) prevent the slider (132) from being disengaged from the closure device (121) in the upward direction. The distance between the bottom portions (115) of fastening strips (130, 131) is larger than the distance (140) between the top portions (117) of the fastening strips (130, 131). If a force is applied to the slider (132) in the upward direction, the bottom portion (115) of the fastening strips (130, 131), may further separate to prevent the slider (132) from being disengaged.

WO 02/15732 A1

CLOSURE DEVICE5                   FIELD OF THE INVENTION

The present invention relates generally to closure devices and, more particularly, to a slider and interlocking fastening strips. The invention is particularly well suited for fastening flexible storage containers, including plastic  
10 bags.

BACKGROUND OF THE INVENTION

The use of closure devices for fastening storage  
15 containers, including plastic bags, is generally known. Furthermore, the manufacture of closure devices made of plastic materials is generally known to those skilled in the art.

20           A particularly well-known use for closure devices is in connection with flexible storage containers, such as plastic bags. In some instances, the closure device and the associated container are formed from thermoplastic materials, and the closure device and the sidewalls of the container are  
25 integrally formed by extrusion as a single piece. In another embodiment, the closure device and sidewalls of the container may be formed as separate pieces and then connected by heat sealing or any other suitable connecting process. In either event, such closure devices are particularly useful in  
30 providing a closure means for retaining matter within the bag.

Conventional closure devices typically utilize mating fastening strips or closure elements, which are used to selectively seal the bag. A slider may be provided for use in opening and closing the fastening strips. The slider may include a separator which extends at least partially between the fastening strips. When the slider is moved in the appropriate direction, the separator divides the fastening strips and opens the bag.

One of the disadvantages of using a slider is that the slider can be disengaged from the slider if a certain amount of force is applied to the slider. In general, the fastening strips are disposed parallel in regards to their bottom and top edges. As the slider is pulled away from the bag, the bottom edges of the fastening strips typically are forced inward, allowing the slider to be pulled away from the fastening strips.

The present invention solves this problem by providing fastening strips wherein the bottom portions of the fastening strips are placed at a further distance than the top portions of the fastening strips. This increases the pull-off force required to disengage the slider from the fastening strips.

#### SUMMARY OF THE INVENTION

The present invention provides a closure device which comprises first and second interlocking fastening strips arranged to be interlocked over a predetermined length. The closure device additionally includes a slider, slidably disposed on the interlocking fastening strips for facilitating the occlusion and deocclusion of the fastening strips when moved towards first and second ends of the

fastening strips. The first and second interlocking fastening strips prevent the slider from being disengaged from the first and second fastening strips by increasing the pull-off force required to disengage the slider. In addition, the presence of a greater separation of the bottom portions of the first and second fastening strips may force the bottom portions outward as the slider is moved upward away from the first and second fastening strips so as to prevent the slider from being disengaged from the fastening strips.

The present invention will become more readily apparent upon reading the following detailed description of exemplified embodiments and upon reference to the accompanying drawings herein.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a container according to the present invention in the form of a plastic bag;

20

Fig. 2 is a fragmentary side view of the container in Fig. 1;

Fig. 3 is a cross-sectional view taken along line 3-3 in Fig. 2;

25

Fig. 4 is a cross-sectional view taken along line 4-4 in Fig. 2;

Fig. 5 is a cross-sectional view of an embodiment;

30

Fig. 6 is a cross-sectional view of another embodiment;  
and

Fig. 7 is a cross-sectional view of another embodiment.

5

#### DESCRIPTION OF THE EMBODIMENTS

Figs. 1-4 illustrate an embodiment of a container in the form of a plastic bag 120 having a sealable closure device 121. The bag 120 includes a first sidewall 122 and a second sidewall 123 joined at seams 125, 126 to define a compartment accessible through the open top end but sealable by means of the closure device 121. The closure device 121 includes first and second fastening strips 130, 131 and a slider 132.

The fastening strips 130, 131 and the slider 132 have a longitudinal X axis 102, a transverse Y axis 104 and a vertical Z axis 106. The transverse Y axis 104 is perpendicular to the longitudinal X axis 102. The vertical Z axis 106 is perpendicular to the longitudinal X axis 102 and the vertical Z axis 106 is perpendicular to the transverse Y axis 104.

The fastening strips 130, 131 are adapted to be interlocked between a first end 127 and a second end 128. The fastening strips 130, 131 are secured together at the first and second ends 127, 128 to form end seals. The fastening strips 130, 131 are angled outward to prevent the slider 132 from being removed from the fastening strips 130, 131 in the direction of the Z axis 106. More specifically, the distance between the first and second fastening strips

130, 131 is greater at the bottom portion 115 than the top portion 117.

5 The slider 132 is mounted onto the fastening strips 130, 131 so that the slider 132 is restrained from being removed from the fastening strips 130, 131 in the Z axis 106 but free to slide along the X axis 102. The slider 132 engages the fastening strips 130, 131 so that when the slider 132 moves in an occlusion direction 114, the  
10 fastening strips 130, 131 interlock and the bag 120 is sealed, and when the slider 132 moves in a deocclusion direction 116, the fastening strips 130, 131 separate and the bag 120 is open.

15 Figs. 3 and 4 illustrate cross-sectional views taken at two points along the slider 132 as shown in Fig. 2. The slider 132 includes a separator 133 that facilitates the deocclusion of the fastening strips 130, 131. The separator 133 includes a first end and a second end. The separator  
20 may be triangular in shape and the first end may be wider than the second end. The fastening strips 130, 131 include closure elements 136, 137 that are engaged and disengaged as the fastening strips 130, 131 are occluded and deoccluded.

25 Fig. 3 illustrates the fastening strips 130, 131 and the slider 132 wherein the fastening strips 130, 131 are fully occluded. The top portion 117 of the fastening strip 130 is at a distance 140 from the top portion 117 of the fastening strip 131. Likewise, the bottom portion 115 of  
30 the fastening strip 130 is at a distance 142 from the bottom portion 115 of the fastening strip 131. In accordance with the present invention, the distance 142 is greater than the



distance 140. The distance 142 is in the range of 10% - 400% greater than the distance 140. In a preferred embodiment, the distance 142 is in the range of 50% - 100% greater than the distance 140. In a more preferred  
5 embodiment, the distance 142 is in the range of 60% - 80% greater than the distance 140. In addition, the distance 142 is wider than the distance 144 of the gap 150 located between the shoulders 152, 154. This prevents the slider 132 from being disengaged from the fastening strips 130, 131  
10 in the direction of the Z axis 106. Furthermore, as the slider 132 is pulled in the direction of the Z axis 106, the distance 142 increases, further adding to the pull-off force required to disengage the slider 132.

15 As noted above, the fastening strips are angled outward. The angle 160 of the fastening strips may be in the range of 3 to 21 degrees, preferably in the range of 9 to 15 degrees, and more preferably in the range of 11 to 13 degrees.

20 Fig. 4 illustrates the fastening strips 130, 131 and the slider 132 wherein the fastening strips 130, 131 have been fully deoccluded. The distance 142 prevents the slider 132 from being disengaged from the fastening strips 130,  
25 131.

In keeping with a general aspect of the present invention and as will be described in greater detail below, the interlocking fastening strips of the present invention  
30 may be of virtually any type or form.

As shown in Fig. 5, the fastening strips may be U-channel fastening strips as described in U.S. Patent 4,829,641. U-channel fastening strips include a first fastening strip 230 with a first closure element 236 and a second fastening strip 231 with a second closure element 234. The first closure element 236 engages the second closure element 234. The first fastening strip 230 may include a flange portion 269. The second fastening strip 231 may include a flange portion 259. The side walls 222, 223 of the plastic bag 220 may be attached to the fastening strips 230, 231 by conventional manufacturing techniques.

The second closure element 234 includes a base portion 238 having a pair of spaced-apart parallelly disposed webs 240, 241, extending from the base portion 238. The base and the webs form a U-channel closure element. The webs 240, include hook closure portions 242, 244 extending from the webs 240, 241 respectively, and facing towards each other. The hook closure portions 242, 244 include guide surfaces 246, 247 which serve to guide the hook closure portions 242, 244 for occluding with the hook closure portions 252, 254 of the first closure element 236.

The first closure element 236 includes a base portion 248 including a pair of spaced-apart, parallelly disposed webs 250, 251 extending from the base portion 248. The base and the webs form a U-channel closure element. The webs 250, 251 include hook closure portions 252, 254 extending from the webs 250, 251 respectively and facing away from each other. The hook closure portions 252, 254 include guide surfaces 245, 255, which generally serve to guide the hook closure portions 252, 254 for occlusion with the hook closure

portions 242, 244 of the second closure element 234. The guide surfaces 245, 255 may also have a rounded crown surface.

5           In accordance with the invention, the webs 241, 251 are longer than the webs 240, 250. In addition, the base portions 238, 248 angle outwardly.

10           The slider 232 includes a top portion 272. The top portion provides a separator 243 having a first end and a second end wherein the first end may be wider than the second end. In addition, the separator 243 may be triangular in shape. When the slider is moved in the occlusion direction, the separator 243 deoccludes the  
15           fastening strips 230, 231 as shown in Fig. 5. Referring to Fig. 5, the closure elements 234, 236 are deoccluded and specifically, the upper hook portions 242, 252 and the lower hook portions 244, 254 are deoccluded.

20           The interlocking fastening strips may comprise "arrowhead-type" or "rib and groove" fastening strips as shown in Fig. 6 and as described in U.S. Patent 3,806,998. The rib element 505 interlocks with the groove element 507. The rib element 505 is of generally arrow-shape in transverse  
25           cross section including a head 510 comprising interlock shoulder hook portions 511 and 512 generally convergently related to provide a cam ridge 513 generally aligned with a stem flange 514 by which the head is connected in spaced relation with respect to the supporting flange portion 508.  
30           (U.S. Patent 3,806,998, Col. 2, lines 16-23). At their surfaces nearest the connecting stem flange 514, the shoulder portions 511 and 512 define reentrant angles therewith

providing interlock hooks engageable with interlock hook flanges 515 and 517 respectively of the groove element 507. (U.S. Patent 3,806,998, Col. 2, lines 23-28). Said hook flanges generally converge toward one another and are spread  
5 open to receive the head 510 therebetween when said head is pressed into said groove element 507 until the head is fully received in a groove 518 of said groove element 507 generally complementary to the head and within which the head is interlocked by interengagement of the head shoulder hook  
10 portions 511 and 512 and the groove hook flanges 515 and 517. (U.S. Patent 3,806,998, Col. 2, lines 28-36). Through this arrangement, as indicated, the head and groove elements 505 and 507 are adapted to be interlockingly engaged by being pressed together and to be separated when forcibly pulled  
15 apart, as by means of a generally U-shaped slider 519. (U.S. Patent 3,806,998, Col. 2, lines 36-41).

The slider 519 includes a flat back plate 520 adapted to run along free edges 521 on the upper ends of the sections  
20 of the flange portions 508 and 509 as shown in the drawing. (U.S. Patent 3,806,998, Col. 2, lines 41-46). Integrally formed with the back plate 520 and extending in the same direction (downwardly as shown) therefrom are respective coextensive side walls 522 with an intermediate spreader  
25 finger 523 extending in the same direction as the side walls at one end of the slider. (U.S. Patent 3,806,998, Col. 2, lines 46-51). The side walls 522 are in the form of panels which are laterally divergent from a narrower end of the slider. (U.S. Patent 3,806,998, Col. 2, lines 51-55). The  
30 slider walls 522 are each provided with an inwardly projecting shoulder structure 524. (U.S. Patent 3,806,998, Col. 2, line 66 to Co. 3, line 1).

The fastening strips in Fig. 6 may be angled as noted above.

5        Additionally, the interlocking fastening strips may comprise "profile" fastening strips, as shown in Fig. 7 and described in U.S. Patent 5,664,299. As shown in FIG. 7, the first profile 616 has at least an uppermost closure element 616a and a bottommost closure element 616b. (U.S. Patent  
10 5,664,299, Col. 3, lines 25-27). The closure elements 616a and 616b project laterally from the inner surface of strip 614. (U.S. Patent 5,664,299, Col. 3, lines 27-28). Likewise, the second profile 617 has at least an uppermost closure element 617a and a bottommost closure element 617b.  
15 (U.S. Patent 5,664,299, Col. 3, lines 28-30). The closure elements 617a and 617b project laterally from the inner surface of strip 615. (U.S. Patent 5,664,299, Col. 3, lines 30-32). When the bag is closed, the closure elements of profile 616 interlock with the corresponding closure elements  
20 of profile 617. (U.S. Patent 5,664,299, Col. 3, lines 32-34). As shown in FIG. 19, closure elements 616a, 616b, 617a and 617b have hooks on the ends of the closure elements, so that the profiles remain interlocked when the bag is closed, thereby forming a seal. (U.S. Patent 5,664,299, Col. 3,  
25 lines 34-37).

The straddling slider 610 comprises an inverted U-shaped member having a top 620 for moving along the top edges of the strips 614 and 615. (U.S. Patent 5,664,299, Col. 4,  
30 lines 1-3). The slider 610 has side walls 621 and 622 depending from the top 620. (U.S. Patent 5,664,299, Col. 4, lines 3-4). A separating leg 623 depends from the top 620

between the side walls 621 and 622 and is located between the uppermost closure elements 616a and 617a of profiles 616 and 617. (U.S. Patent 5,664,299, Col. 4, lines 26-30). The fastening assembly includes shoulders 621b and 622b on the  
5 side walls of the slider. (U.S. Patent 5,664,299, Col. 4, lines 62-65). The shoulders act as means for maintaining the slider in straddling relation with the fastening strips. (U.S. Patent 5,664,299, Col. 5, lines 4-7).

10 The fastening strips in Fig. 7 may be angled as noted above.

Also, the interlocking fastening strips may be "rolling action" fastening strips as shown in Fig. 8 and described in  
15 U.S. Patent 5,007,143. The strips 714 and 715 include profiled tracks 718 and 719 extending along the length thereof parallel to the rib and groove elements 716 and 717 and the rib and groove elements 716, 717 have complimentary cross-sectional shapes such that they are closed by pressing  
20 the bottom of the elements together first and then rolling the elements to a closed position toward the top thereof. (U.S. Patent 5,007,143, Col. 4, line 62 to Col. 5, line 1). The rib element 716 is hook shaped and projects from the inner face of strip 714. (U.S. Patent 5,007,143, Col. 5,  
25 lines 1-3). The groove element 717 includes a lower hook-shaped projection 717a and a relatively straight projection 717b which extend from the inner face of strip 715. (U.S. Patent 5,007,143, Col. 5, lines 3-6). The profiled tracks 718 and 719 are inclined inwardly toward each other from  
30 their respective strips 714 and 715. (U.S. Patent 5,007,143, Col. 5, lines 6-8).

The straddling slider 710 comprises an inverted U-shaped plastic member having a back 720 for moving along the top edges of the tracks 718 and 719 with side walls 721 and 722 depending therefrom for cooperating with the tracks and  
5 extending from an opening end of the slider to a closing end. (U.S. Patent 5,007,143, Col. 5, lines 26-31). A separator finger 723 depends from the back 720 between the side walls 721 and 722 and is inserted between the inclined tracks 718 and 719. (U.S. Patent 5,007,143, Col. 5, lines 34-36). The  
10 slider 710 has shoulders 721a and 722a projecting inwardly from the depending side walls 721 and 722 which are shaped throughout the length thereof for cooperation with the depending separator finger 723 in creating the rolling action in opening and closing the reclosable interlocking rib and  
15 groove profile elements 716 and 717. (U.S. Patent 5,007,143, Col. 5, lines 43-49).

The fastening strips in Fig. 8 may be angled as noted above.

20

Although several interlocking fastening strip embodiments have been specifically described and illustrated herein, it will be readily appreciated by those skilled in the art that other kinds, types, or forms of fastening  
25 strips may alternatively be used without departing from the scope or spirit of the present invention.

The interlocking fastening strips may be manufactured by extrusion through a die. The interlocking fastening  
30 strips may be formed from any suitable thermoplastic material including, for example, polyethylene, polypropylene, nylon, or the like, or from a combination thereof. Thus, resins or

mixtures of resins such as high density polyethylene, medium density polyethylene, and low density polyethylene may be employed to prepare the interlocking fastening strips. For example, the fastening strips may be made from low density polyethylene.

When the fastening strips are used in a sealable bag, the fastening strips and the films that form the body of the bag may be conveniently manufactured from heat sealable material. In this way, the bag may be economically formed by using an aforementioned thermoplastic material and by heat sealing the fastening strips to the bag. For example, the bag may be made from a mixture of high pressure, low density polyethylene and linear, low density polyethylene.

The fastening strips may be manufactured by extrusion or other known methods. For example, the closure device may be manufactured as individual fastening strips for later attachment to the bag or may be manufactured integrally with the bag. In addition, the fastening strips may be manufactured with or without flange portions on one or both of the fastening strips depending upon the intended use of the fastening strips or expected additional manufacturing operations.

The fastening strips can be manufactured in a variety of forms to suit the intended use. The fastening strips may be integrally formed on the opposing sidewalls of the container or bag, or connected to the container by the use of any of many known methods. For example, a thermoelectric device may be applied to a film in contact with the flange portion of the fastening strips or the thermoelectric device



may be applied to a film in contact with the base portion of fastening strips having no flange portion, to cause a transfer of heat through the film to produce melting at the interface of the film and a flange portion or base portion of the fastening strips. Suitable thermoelectric devices include heated rotary discs, traveling heater bands, resistance-heated slide wires, and the like. The connection between the film and the fastening strips may also be established by the use of hot melt adhesives, hot jets of air to the interface, ultrasonic heating, or other known methods. The bonding of the fastening strips to the film stock may be carried out either before or after the film is U-folded to form the bag. In any event, such bonding is done prior to side sealing the bag at the edges by conventional thermal cutting. In addition, the first and second fastening strips may be positioned on opposite sides of the film. Such an embodiment would be suited for wrapping an object or a collection of objects such as wires. The first and second fastening strips should usually be positioned on the film in a generally parallel relationship with respect to each other, although this will depend on the intended use.

The slider may be multiple parts and snapped together. In addition, the slider may be made from multiple parts and fused or welded together. The slider may also be a one piece construction. The slider can be colored, opaque, translucent or transparent. The slider may be injection molded or made by any other method. The slider may be molded from any suitable plastic material, such as, nylon, polypropylene, polystyrene, acetal, toughened acetal, polyketone, polybutylene terephthalate, high density polyethylene, polycarbonate or ABS (acrylonitrile-butadiene-styrene).

From the foregoing it will be understood that modifications and variations may be effectuated to the disclosed structures - particularly in light of the foregoing  
5 teachings - without departing from the scope or spirit of the present invention. As such, no limitation with respect to the specific embodiments described and illustrated herein is intended or should be inferred. In addition, all references and copending applications cited herein are hereby  
10 incorporated by reference in their entireties.

WHAT IS CLAIMED IS:

1. A closure device, comprising:

5 first and second interlocking fastening strips arranged to be interlocked over a predetermined length between first and second ends,

the fastening strips have a longitudinal X axis, the fastening strips have a transverse Y axis, the transverse Y  
10 axis is perpendicular to the longitudinal X axis, the fastening strips have a vertical Z axis, the vertical Z axis is perpendicular to the longitudinal X axis, the vertical Z axis is perpendicular to the transverse Y axis,

a slider slidably disposed on the fastening strips for  
15 movement between the first and second ends, the slider facilitating occlusion of the fastening strips when moved towards the first end, the slider facilitating the deocclusion of the fastening strips when the slider is moved towards the second end,

20 the first fastening strip has a first top portion and a first bottom portion, the second fastening strip has a second top portion and a second bottom portion, the top portions are separated by a first distance when occluded, the bottom portions are separated by a second distance when occluded,  
25 the second distance is greater than the first distance.

2. The invention as in claim 1 wherein the first fastening strip has a first base portion, the first base portion angles outwardly in the Y axis from the top portion  
30 to the bottom portion.

3. The invention as in claim 2 wherein the second fastening strip has a second base portion, the second base portion angles outwardly in the Y axis from the top portion to the bottom portion.

5

4. The invention as in claim 1 wherein the second distance increases when the slider is moved in the Z axis away from the fastening strips.

10

5. The invention as in claim 1 wherein the slider has shoulders, the shoulders are separated by a third distance, the third distance is less than the second distance.

15

6. The invention as in claim 1 wherein the second distance is in the range of 10% - 400% greater than the first distance.

20

7. The invention as in claim 1 wherein the second distance is in the range of 50% - 100% greater than the first distance.

25

8. The invention as in claim 1 wherein the second distance is in the range of 60% - 80% greater than the first distance.

25

9. The invention as in claim 2 wherein the first base portion is at an angle to the Z axis in the range of 3 degrees to 21 degrees.

30

10. The invention as in claim 2 wherein the first base portion is at an angle to the Z axis in the range of 9 degrees to 15 degrees.

11. The invention as in claim 2 wherein the first base portion is at an angle to the Z axis in the range of 11 degrees to 13 degrees.

5

12. The invention as in claim 3 wherein a first web extends from the first base portion, the first web includes a hook portion, a second web extends from the second base portion, the second web includes a hook portion.

10

13. A container comprising:

first and second sidewalls which form a compartment with an opening,

the first and second interlocking fastening strips respectively connected to the first and second sidewalls at the opening,

the first and second interlocking fastening strips arranged to be interlocked over a predetermined length between first and second ends,

the fastening strips have a longitudinal X axis, the fastening strips have a transverse Y axis, the transverse Y axis is perpendicular to the longitudinal X axis, the fastening strips have a vertical Z axis, the vertical Z axis is perpendicular to the longitudinal X axis, the vertical Z axis is perpendicular to the transverse Y axis,

a slider slidably disposed on the fastening strips for movement between the first and second ends, the slider facilitating occlusion of the fastening strips when moved towards the first end, the slider facilitating the deocclusion of the fastening strips when the slider is moved towards the second end,

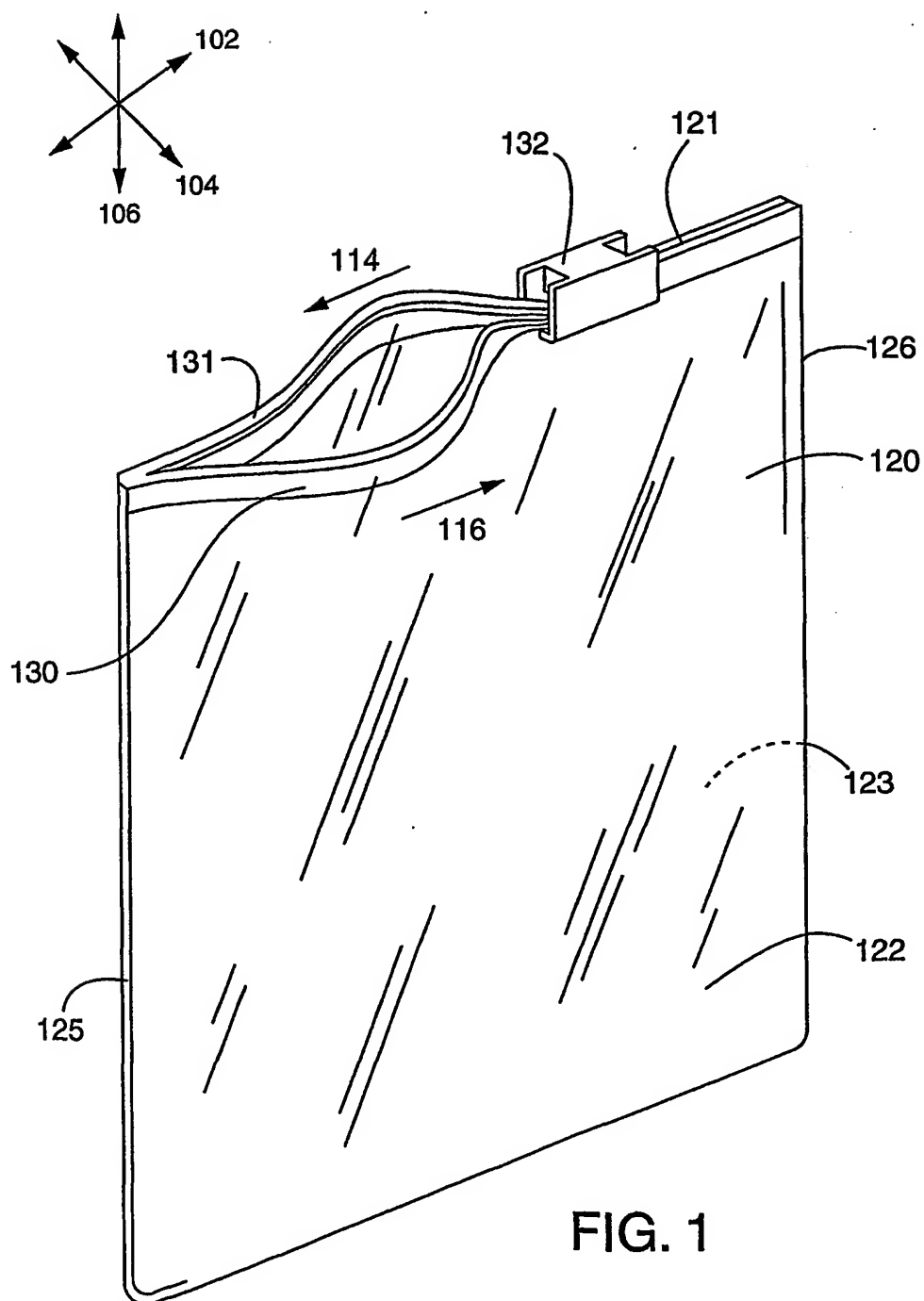
the first fastening strip has a first top portion and a first bottom portion, the second fastening strip has a second top portion and a second bottom portion, the top portions are separated by a first distance when occluded, the bottom portions are separated by a second distance when occluded, the second distance is greater than the first distance.

14. A method of manufacturing a closure device, comprising:

10 providing first and second interlocking fastening strips arranged to be interlocked over a predetermined length between first and second ends, the fastening strips have a longitudinal X axis, the fastening strips have a transverse Y axis, the transverse Y axis is perpendicular to the longitudinal X axis, the fastening strips have a vertical Z axis, the vertical Z axis is perpendicular to the longitudinal X axis, the vertical Z axis is perpendicular to the transverse Y axis,

20 providing a slider slidably disposed on the fastening strips for movement between the first and second ends, the slider facilitating occlusion of the fastening strips when moved towards the first end, the slider facilitating the deocclusion of the fastening strips when the slider is moved towards the second end, the first fastening strip has a first top portion and a first bottom portion, the second fastening strip has a second top portion and a second bottom portion, the top portions are separated by a first distance when occluded, the bottom portions are separated by a second distance when occluded, the second distance is greater than the first distance.

1/6



2/6

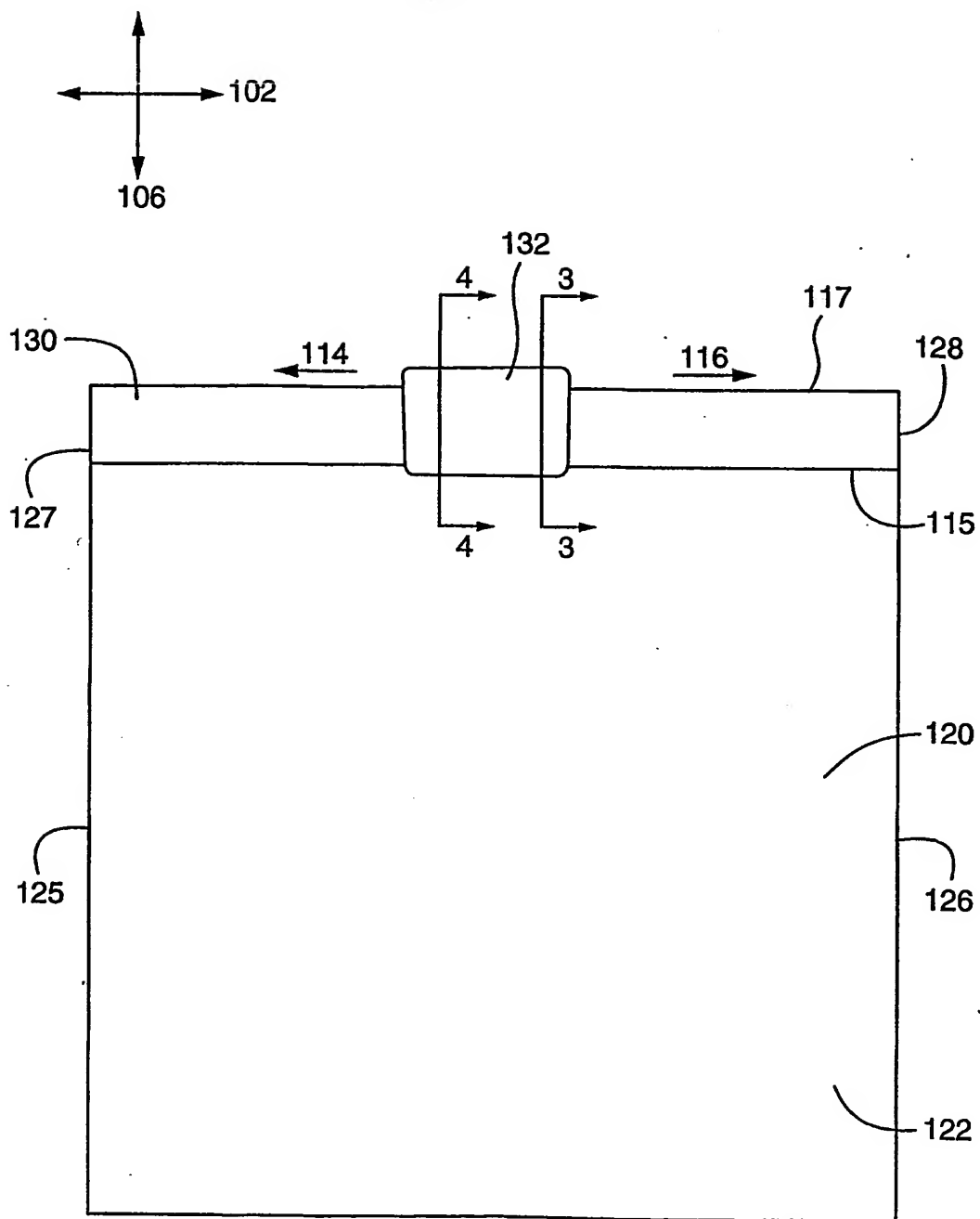


FIG. 2



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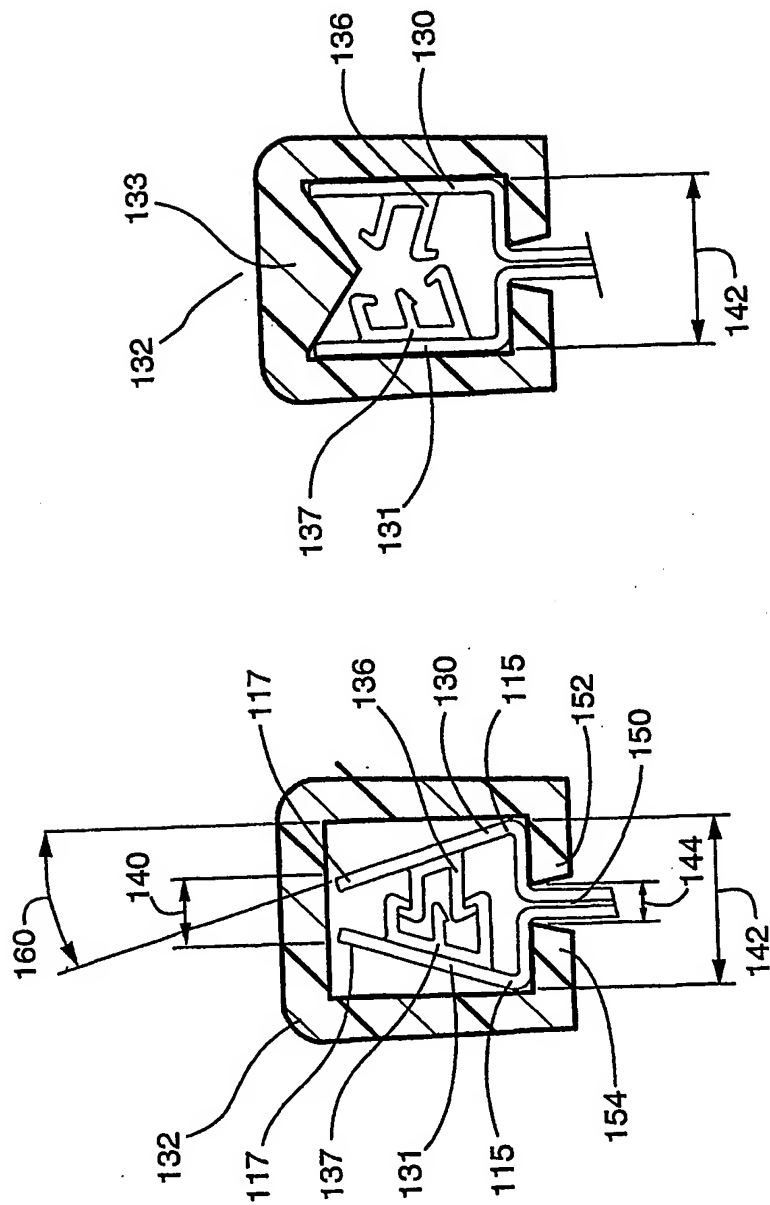


FIG. 4

FIG. 3

4/6

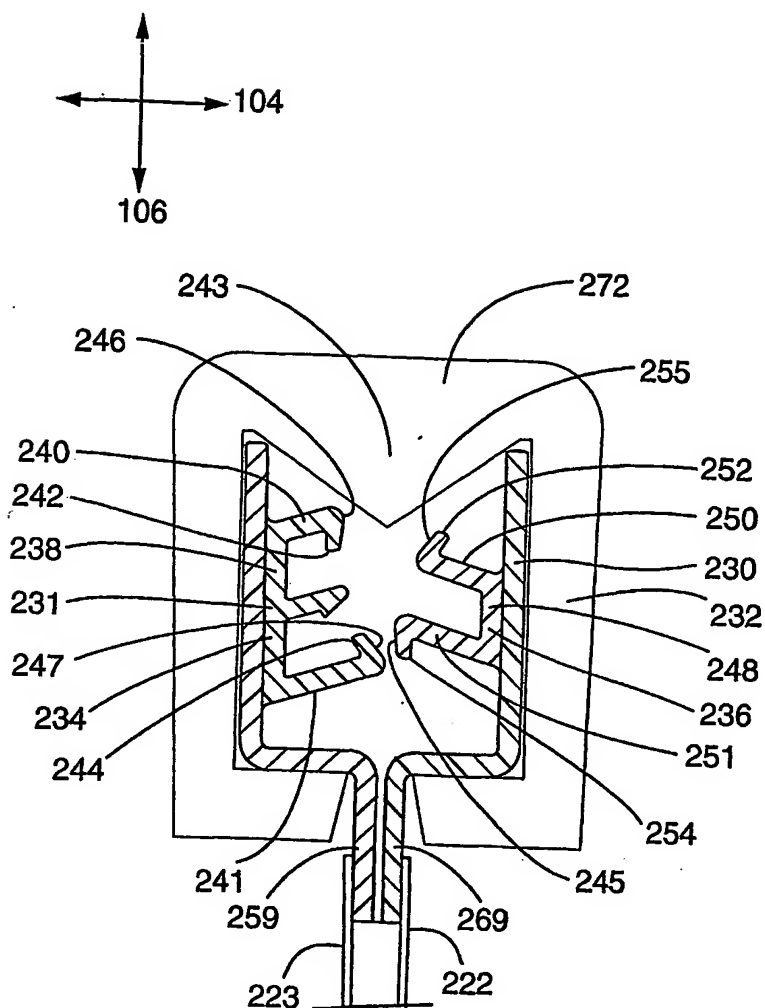
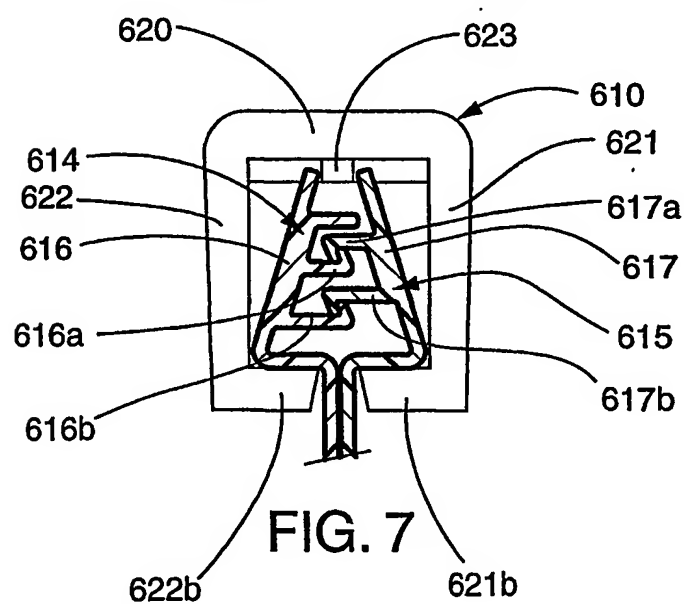
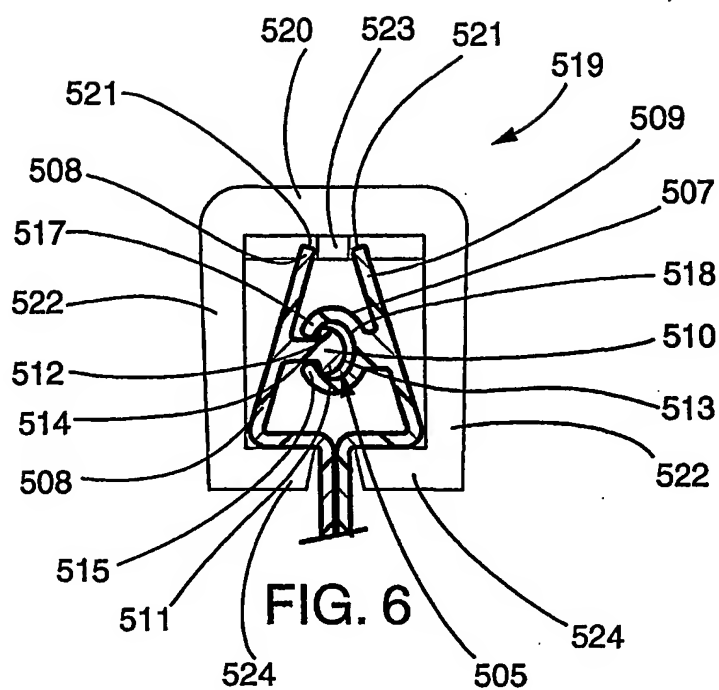


FIG. 5

5/6



6/6

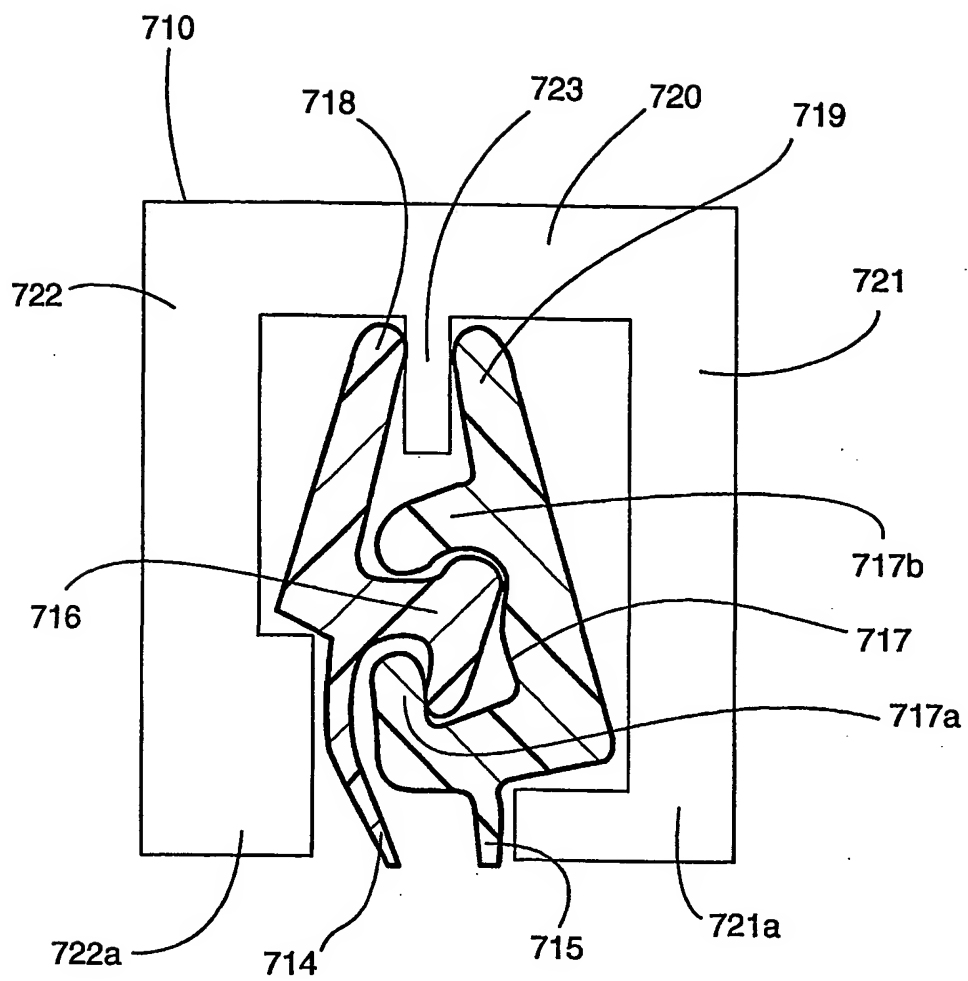


FIG. 8